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THE OPEN UNIVERSITY OF SRI LANKA

B.Sc. DEGREE IN SCIENCE

INDUSTRIAL CHEMISTRY – CMU3232

FINAL EXAMINATION 2017/18

Duration: Three hours (03)

Date: 05.04.2019 **Time: 9.30 a.m. – 12.30 p.m.**

Part II (60 marks)

Answer **four (04)** out of **six** questions including the **compulsory question number one.** **Handover the answer script of Part II separately.**

1.a. i. What do you understand by the term "throwing power" of an electroplating solution?

ii. Define the term "perfect throwing power" of an electroplating solution.

iii. List the main factors that determine the throwing power.

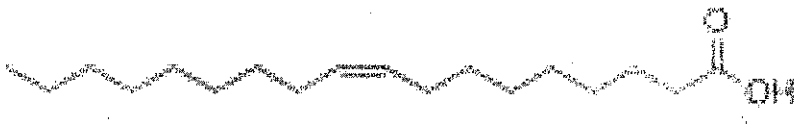
iv. What is meant by the term "anodysing" of a metal?

(25 marks)

b. i. What is meant by the term "Äutoxidation" of fatty acids?

ii. State **two** factors that affect the rate of autoxidation.

iii. Give **two** possible primary oxidation products from oleic acid (structure is given below).



(30 marks)

c. i. How is acrylonitrile produced from propylene?

ii. What are the industrial uses of acrylonitrile?

(25 marks)

d. i. State the function of ball mill in ceramic industry.

ii. Why is the said function important?

(20 marks)

2. a. Compare the melting points of glass and potassium chloride. Relate this information to the internal structure of the two substances.

(20 marks)

b. Consider the glass types below.

Soda glass Coloured glass borosilicate glass Tempered glass

In a laboratory which is more suitable for the preparation of

i. Capillaries
ii. Boiling tubes

Give reasons for your choice.

(20 marks)

c. A glass technologist is interested in the preparation of coloured glass tumblers for the market. Out of the chemicals PbO, Na_2O, Al_2O_3, CoO and Cr_2O_3 which is/are more suitable to add to a mixture to serve his purpose? Give reasons.

(10 marks)

d. Explain what is meant by "ion exchange capacity of clays".

(20 marks)

e. i. Name **two** advantages of a glaze on a ceramic body.

ii. Why is it important to select carefully the firing temperature of a glaze?

iii. State how a transparent glaze does differs from an opaque glaze.

(30 marks)

3. a. i Write down the essential steps in the manufacture of Portland cement. What is the most important step in manufacturing process?

ii. Draw the flow diagram for the manufacture of Portland cement by dry process.

(40 marks)

b. i. Draw the rotary kiln for the wet process showing the different temperature zones within it

ii. Identify the type of reactions that take place within these temperature zones.

(30 marks)

c. i. Distinguish between 'flash setting and false setting'.

ii. Compare the setting behaviour, temperature rise during hydration and development of strength of the phases, C_2S and C_4AF when they undergo hydration.

(30 marks)

4.a. The principal source of phosphorous compounds is phosphate rock - a complex material - containing the mineral fluoro-apatite, $[3Ca_3(PO_4)_2.CaF_2]$.

i. Describe the advantages of using triple superphosphate (TSP).

ii. Using balanced chemical equation show how TSP can be produced from fluoro-apatite.

(25 marks)

b. Suggest and describe the most suitable value addition product from Eppawala phosphate deposit in terms of economic viability.

(25 marks)

c. The mineral sands are generally found in areas on or closer to the beaches in sand dunes. Sri Lanka has one of the richest mineral sand deposits in the world.

i. What do you mean by the term 'mineral sands'?

ii. Name **three (03)** main mineral sands found in Pulmudai, Sri Lanka.

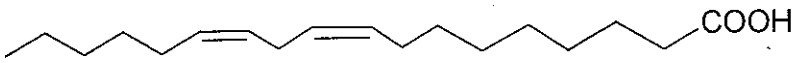
iii. Describe value addition technique of **one (01)** of the minerals (only steps are required).

(25 marks)

d. Explain the refining method of zircon (pure and less pure) into zirconium metal.

(25 marks)

5.a. i. Unsaturated fatty acids are classified as ω_x series.



Linoleic Acid

i. Classify Linoleic acid as ω_x series.

ii. Give a short hand notation for Linoleic acid.

iii. Write down the IUPAC name for Linoleic acid.

(15 marks)

b. i. Briefly explain the following terms.

1. Smoke point 2. Flash point

3. Acid value

ii. What is meant by the term saponification number?

iii. Briefly explain how you would determine saponification number of a fat.

iv. 5.00 g of fat sample requires 25.80 ml of 0.5 M HCl to neutralize the unreacted KOH and 58.60 ml of the same acid was consumed during blank titration. Calculate the saponification number of the fat. [Relative atomic mass: K= 39; O = 16; H = 1].

(45 marks)

c. i. What is meant by "photooxidation"?

ii. State **three** factors that affect photooxidation.

(15 marks)

d. In the process of pretreatment of palm kernels the following unit operations are carried out. Explain the purpose of each unit process.

1. Size reduction
2. Flaking
3. Steam conditioning
4. Screw pressing
5. Clarification

(25 marks)

6. a. i. Briefly explain what is catalytic cracking of petroleum.

ii. What are the advantages of catalytic cracking?

iii. Catalytic cracking takes place via carbocation intermediates. Write down the possible products that could be formed by the catalytic cracking of n- pentene.

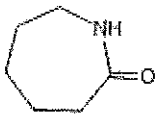
(45 marks)

b. Explain how phenol is prepared from Cumene (isopropylbenzene). Show the mechanism involved.

(30 marks)

c. i. How is caprolactum (structure is given below) produced from phenol?

ii. State industrial use of caprolactum.



(25 marks)

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